

A STUDY OF INCREASED INSTRUCTIONAL TIME  
AND THE RELATIONSHIP WITH  
THE MATHEMATICAL ACHIEVEMENT  
OF INTERMEDIATE ELEMENTARY STUDENTS

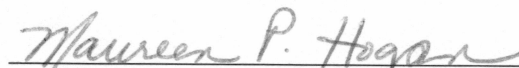
By

Elizabeth Anne Lower

RECOMMENDED:



Advisory Committee Co-Chair

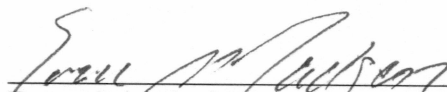


Advisory Committee Co-Chair



Chair, Graduate Department, School of Education

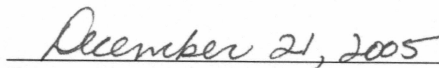
APPROVED:



Dean, School of Education



Dean of the Graduate School



Date

A STUDY OF INCREASED INSTRUCTIONAL TIME  
AND THE RELATIONSHIP WITH  
THE MATHEMATICAL ACHIEVEMENT  
OF INTERMEDIATE ELEMENTARY STUDENTS

A  
THESIS

Presented to the Faculty  
of the University of Alaska Fairbanks

in Partial Fulfillment of the Requirements  
for the Degree of

MASTERS OF EDUCATION

By

Elizabeth Anne Lower, B. A.

Fairbanks, Alaska

August 2005

QA  
135.6  
L69  
2005



## Abstract

The purpose of this study was to determine whether two different approaches to increased instructional time led to a statistically significant increase in math achievement of fifth grade students. The null hypothesis stated that there would not be a statistically significant difference at the .05 level of significance between the math scores of the fifth grade students at schools A and B, as measured by standardized test scores. Data consisted of standardized test scores of annual statewide assessments. The test results were collected and analyzed using SPSS software. The null hypothesis could not be rejected. The results indicated that the largest gains were made by the lowest achieving students. Additionally, in both schools, the students who had scored in the highest quartile on the pre-test were not able to maintain their quartile ranking, and slipped into lower quartile rankings after the different time treatments were applied.

## Table of Contents

Signature Page .....	i
Title Page .....	ii
Abstract .....	iii
Table of Contents. ....	iv
List of Figures .....	vi
List of Tables .....	vii
Chapter 1 Introduction to the Study .....	1
1.1 General Background of the Study .....	1
1.1.1 What Problems Are Surfacing in Most Schools? .....	1
1.1.2 Current Trends in Approaches to Boost Achievement .....	2
1.1.3 General Knowledge About the Research Problem. ....	3
1.3 Problem Statement .....	3
1.4 Professional Significance of the Problem .....	3
1.5 Delimitations of the Study .....	4
Chapter 2 Review of the Literature .....	5
2.1 The Achievement Gap in Math .....	5
2.1.1 The Achievement Gap at the National Level .....	6
2.1.2 The Achievement Gap in Alaska .....	7
2.2 Different Ways that Time is Referred to and Conceptualized .....	10
2.3 Factors Contributing to Academic Achievement .....	13
2.3.1 Using Time Wisely .....	14

2.3.2 Class Size .....	17
2.3.3 Instructional Practices .....	20
2.4 Summary of the Literature Review .....	23
Chapter 3 Methodology .....	26
3.1 The General Perspective .....	26
3.2 The Research Context/Participants .....	26
3.3 Instrumentation .....	28
3.4 Procedures Used .....	29
3.5 Data Collection and Analysis .....	29
Chapter 4 Results of the Study .....	31
4.1 School A .....	31
4.2 School B .....	32
4.3 Chapter Summary .....	36
Chapter 5 Summary and Discussion .....	38
5.1 Discussion .....	38
5.2 Limitations of the Study .....	41
5.3 Areas for Future Research .....	42
5.4 Conclusion .....	43
References .....	45

## List of Figures

Figure 3.1 Demographic Comparison .....	27
Figure 4.1 Comparison of Mean Pre-and Posttest Scores .....	31

## List of Tables

Table 4.1 School B Pre- and Posttest Data With and Without Outlier Data . . . . .	33
Table 4.2 Comparison of Mean Differences by Pretest National Quartile . . . . .	40
Table 4.3 Comparison of Number of Students in Each National . . . . . Quartile Ranking	40
Table 4.4 Comparison of Pre- and Posttest Quartile Ranking By. . . . . Student	41

## Chapter One

### Introduction to the Study

Schools and teachers are more and more being evaluated by students' achievement on standardized tests. Schools and school districts are under fierce scrutiny, not only with regard to their overall test scores, but also with regard to the achievement of specific groups of students. One approach to improving student scores on standardized tests is to tailor instruction to specific areas of weakness by increasing the amount of time devoted to instruction in these areas.

This exploratory study seeks to understand the relationship between two approaches to increased instructional time in math and the math achievement of fifth-grade students on a standardized test. The first chapter introduces the study.

### General Background of the Study

#### *What Problems Are Surfacing in Most Schools?*

Even before the passage of NCLB, disparities among the academic achievement levels of different populations have plagued the field of education. Like many laws preceding it, NCLB also attempts to address the achievement of overall populations and of several specific populations, this time by outlining a detailed plan of repercussions for schools that do not meet state and federal guidelines for "adequate yearly progress" (AYP) with specific populations.

Schools are looking for the most effective means to improve instruction and learning in a targeted manner with limited time and resources, but without sacrificing segments of the curriculum not included on standardized tests. The school district where

this study takes place was placed on a District Improvement Plan in the fall of 2004 because certain populations of students failed to make AYP in math, among other subject areas. Conditions of a District Improvement Plan require that individual schools develop a plan to address the achievement issue at their school, and then submit the plan to their district office. Two schools in this study randomly and voluntarily chose to implement different configurations of instructional time as the crux of their plan.

#### *Current Trends in Approaches to Boost Achievement*

Individual states, school districts, and administrators have attempted to improve educational outcomes in many different ways. Some examples include limiting class size (Nye, Hedges, & Konstantopoulos, 2002; Wilkins, 2002; & Fidler 2001), increasing instructional time or time on task (Fisher, Mariliave, & Filby, 1977; Carroll, 1963), and analyzing instructional practices as they relate to student achievement (Dempster, 1978, McGrath & Rust, 2002, Baugous & Bendery, 2002). Regardless of the approach a state or school district employs to improve educational outcomes, additional support is often necessary. Opponents of legislation such as NCLB argue that the mandate does not provide this essential support. As a result, schools and districts resort to measures like narrowing the curriculum, eliminating subjects such as social studies, science, and art. The idea is that by focusing only on the essential subjects, students will be more prepared for the material they will see on the tests. This approach is referred to as “teaching to the test” and is unpopular with many teachers and parents, but is utilized for lack of a better solution (Montgomery, Ranney, & Growe, 2003).



### *General Knowledge About the Research Problem*

Additional instructional time, the focus of this research project, has been studied for many decades (Carroll, 1963, Bloom, 1974, Walberg, 1988, & Leonard, 2001). There is a large body of research that has shown that increased instructional time can be effective in increasing desired educational outcomes (Suarez, Torlone, McGrath, & Clark, 1991, Fidler, 2002, Bloom, 1974, Baugous & Bendery, 2000, Fisher, Marliave, & Filby, 1977). However, these researchers note that there are qualitative differences in how time is spent in school (i.e., the types of activities that students are engaged in, the ways in which teacher make use of segments of time, and other instructional practices that are dependent upon the amount of time available to them.).

### *Problem Statement*

This exploratory study seeks to understand the relationship between two different approaches to increased instructional time and the math achievement two schools. I propose to test the following null hypothesis: There will not be a difference at the .05 level of significance among the math scores of fifth grade students at schools A and B, as measured by a standardized test.

### *Professional Significance of the Problem*

School reform initiatives have long recognized the achievement gap exists between white and minority students in math. While this gap narrowed slightly overall (one percentage point between 2002, 2003 & 2004), the gap between white students and African American students widened (U.S. Department of Education, 2004). In Alaska in



1996, the gap in math achievement between Latino and white students was 33 percentage points or the equivalent of three years behind (The Education Trust, 2001).

The accountability standards and requirements of NCLB to disaggregate and report data from standardized tests have exposed the severity of the disparity between test performance of White and minority students. Research addressing the success of the measures taken by schools and school districts to address performance on standardized tests will be valuable. The outcomes of this research may also enable educators and administrators to more efficiently implement changes in their schools; that is, they will have evidence of the positive, negative, or neutral effects of adapting their scheduling and use of instructional time as measured by standardized test scores.

#### Delimitations of the Study

This scope of this study was narrowed by analyzing the math achievement of current fifth grade students from two different elementary schools. Achievement will be measured using the state mandated standardized test scores from tests administered each spring. The overall class performance as well as the disaggregated data will be analyzed.

## Chapter Two

### Review of the Literature

The effectiveness of schools and teachers is more and more being measured by students' achievement on standardized tests. Schools and school districts are under fierce scrutiny, not only with regard to their overall test scores, but also with regard to the achievement of specific groups of students. One approach to improving student scores on standardized tests is to tailor instruction to specific areas of weakness by increasing the amount of time devoted to instruction in these areas. This review of the literature examines research on the use of time as a factor in increasing the mathematical achievement of intermediate elementary students.

A review of the research related to the role that time plays in education yields several themes. The themes included in this discussion and synthesis include the achievement gap between White and non-White students' mathematics scores on standardized tests at the elementary level, the many different ways that time is referred to and conceptualized, and finally, research on other factors related to academic achievement and the role that time plays in them.

### The Achievement Gap in Math

This section examines data that confirm a gap in mathematics achievement between White and non-White students. The problem exists at national, state, and district-wide levels and is being measured and monitored with a variety of standardized tests and reporting systems under No Child Left Behind (NCLB). Since a major tenet of NCLB is to ensure equity in education, schools and school districts are searching for

effective ways to close the gap in achievement between White students and their non-White peers.

*The Achievement Gap at the National Level*

According to Kati Haycock (2002) of the Education Trust in Washington D.C., the achievement gap was narrowing during the 1970's and 1980's; however, during the 1990's, Black and Latino students did not continue to make the gains that their peers did in the previous two decades. Haycock stated, "at the turn of the century, the data tell a very stark story. African American and Latino students in twelfth grade have skills in mathematics that are identical to White students in eighth grade" (2002, p. 7). Harold Wenglinsky (2004) also pointed out that while the achievement gap was narrowing in the 1970's and 1980's, minority achievement did not remain on the same trajectory.

Research conducted by Jaekyung Lee (2002) addressed the reasons for the narrowing and widening of the achievement gap during the 1970's, 1980's, and 1990's. He suggested that low-performing students made more gains during a time when curriculum and instruction emphasized minimum academic competency, but the same students slipped behind when the emphasis was shifted to practices that focused on higher learning standards. Achievement of higher performing White students remained stagnant during the 1970's and 1980's, when minimum skills competencies throughout the curriculum were emphasized. However, the achievement of White students once again increased when the standards shifted back toward higher-level, problem-solving instruction. Unfortunately, this shift coincided with the decline in non-White student achievement.

In a summary released by the U.S. Department of Education, data were collected from states from the only twenty-three states from which three years (2002, 2003, 2004) of data were available (Education Trust, Inc., 2004). The data were compiled and analyzed. During this three-year period, 22 of the 23 states reported an increase in overall math performance. However, the African American-White gap remained the same in one state and widened in two of the twenty-three states. The Latino-White gap widened in three states and remained the same one state; and finally, the Native-American-White gap widened in two states and made no change in two states.

Research has documented that, on a national level, the achievement gap between White and non-White students has narrowed and widened over the course of several decades, perhaps reflecting positive and negative impacts of different instructional practices (Lee, 2002; Haycock, 2002). In the next section, data specifically related to the state of Alaska will be reviewed and compared to the nation as a whole.

### *The Achievement Gap in Alaska*

Elementary students in Alaska have been assessed with two different tests. Third and sixth grade students have taken the Alaska Benchmark test, while fourth and fifth grade students have taken the Terra Nova/CAT 6. Student scores have been ranked into four categories: advanced proficient, proficient, below proficient and far below proficient. For reporting purposes the first two and last two categories are often combined and represented as “advanced/proficient” and “below/not proficient.” Prior to 2003, the State of Alaska did not collect statewide data for fifth grade assessments. It should also be noted that the categories are not quartile rankings, but are categories determined by cut

scores established by a committee process of the Alaska Department of Education and Early Development. Additionally, the percentages presented reflect the percentage of students who participated in testing rather than the entire population. In each subgroup discussed here, the participation rate was higher than the 95% required to meet the Adequate Yearly Progress (AYP) requirements of NCLB.

Results assembled by the Alaska Department of Education and Early Development from the years 2003 and 2004 illustrate the achievement gap that existed in Alaska between White and non-White students (Education Trust, Inc., 2004). In this section, only standardized test data from the fifth grade level are being analyzed. The overall percentage of students ranked “below/not proficient” remained relatively unchanged from 36.4% in 2003 to 35.4% in 2004. Likewise, the number of White students ranked “below/not proficient” from 2003 to 2004 remained relatively stable: 24.8% in 2003 to 24.6% in 2004. However, in 2003, over half of the African American students (53.7%) who took the Terra Nova/CAT 6 scored in the “below/not proficient range.” This percentage decreased somewhat in 2004 to 46.4%, but still remained quite high in proportion to the number of White students who scored in the same range. The ranking of Hispanic students in Alaska has improved in the last two years from 50.5% at the “below/not proficient” in 2003 to 41.8% in 2004, but a gap between Hispanic and White students still clearly existed.

Of all of the race/ethnicity designations, Alaska Native students had the highest percentage of students scoring in the “below/not proficient range:” 57.7% in 2003 and

57.2% in 2004. This high percentage is alarming in and of itself, but the fact that the percentage has remained relatively stable over the two years is additionally worrisome.

When Alaska's testing data are disaggregated, it is clear that education practitioners and policy makers have a long way to go to end the disparity between White and non-White elementary students in math. Because federal reporting guidelines are still relatively new, there are missing data which could provide more insight into the history of the inequity problem in Alaska. For example, it is possible that, if these data existed, they would show a narrowing of the gap between White students and their non-White counterparts over the course of many years. However, despite these missing pieces, it is not difficult to illustrate that there is an immediate need to address the conditions which create and contribute to the achievement gap between White and non-White students.

The federal requirements and consequences detailed in NCLB have been and will continue to be widely disputed by administrators, teachers, and parents. Despite the contentious politics involved in NCLB, it is important to bear in mind that requirements to report data related to the progress of specific subgroups of students can provide all of education's stakeholders with valuable information. While there are philosophical differences about the use of standardized tests as a valid measure of academic achievement, the idea of making test results of all populations public information and of continually examining the data for trends and patterns is important if progress is to be made in changing the aspects of public education that result in the achievement gap that continue to burden public education.



This section has presented data and research which illustrate that the disparity between White and minority students' achievement in math exists at a national and state level. The degree to which White students are outperforming African American, Latino, and Alaska Native students in Alaska requires the attention and action of teachers, administrators and state policymakers. The next section describes the historic and current conceptualizations and definitions of time and its uses in school.

#### Different Ways That Time is Referred to and Conceptualized

Time is referred to and conceptualized in many different ways. In some cases, different descriptions are used for similar conceptualizations, while in other cases descriptors refer to broad and narrow or sub- categories of time. This section will compare and contrast many different definitions and conceptualizations of time in the school context.

Beginning from the broadest conceptualization is *allocated time*. Allocated time is generally referred to as the amount of time scheduled for school: The school calendar or number of school days in a year (Bloom, 1974; Fisher, Marliave & Filby, 1977). The number of school days is typically a minimum number required by state or federal law. One cannot assume that because the school year has a set number of days, that students are in attendance all of those days however. The terms *exposure* or *attendance* make this distinction and are defined as the time a student is present at school (Bloom, 1974; Walberg, 1988).

Benjamin Bloom (1974) measured *elapsed time* as the amount of time spent from the beginning of the unit until the completion of the unit at the criterion level of mastery.

This is to say that while a teacher may plan to spend two weeks on a unit or topic, the actual time that it takes for the students to learn the material to a desired level of mastery may be shorter or longer. In the literature reviewed for this thesis, this was the only reference to a time period of this type, an interesting note because it implies a review of time passed whereas other definitions pertain to intended or planned use of time.

The next level is *instructional time*. Instructional time has been broadly defined as the amount of time that the teacher is engaged in teaching activities (Bloom, 1974, Lysiak, 1980, Fisher, Mariliave & Filby, 1977, Greenwood, Horton, & Utley, 2002). Lysiak (1980) described activities that take place during instructional time as “direct teaching, testing, audio-visual, applied instruction with teacher aid, applied instruction without teacher aid, and instructional related management activities” (p. 1). These examples appear consistently throughout the literature as descriptions of activities that comprise instructional time. Closely related to this definition is *allotted time*. *Allotted instructional time* is defined by Suarez, Torlone, McGrath, & Clark (1991) as the amount of time within the school day that teachers plan for instruction. This time excludes lunch, recess and times when the students are under the instruction of another teacher (music, physical education, library, etc.).

Fisher Mariliave, & Filby (1977) distinguished between *engaged* and *unengaged instructional time*, describing engaged instructional time as the time the teacher devotes to the instructional activities referred to above. Fisher, Mariliave & Filby’s (1977) definition of unengaged instructional time mirrors Lysiak’s (1980) definition of *management activities* i.e., activities other than direct instruction (taking roll, signing



slips, transitioning between activities, receiving phone calls, visitors etc.). In their research of the relationship between organizational structure and student achievement, McGrath & Rust (2002) also investigated *transition time*, the amount of time spent shifting from one activity to another.

Instructional time, in all of the forms discussed here, describes the activities of the teacher. However, the terms *time on task* and *engaged time* are often used to describe the activities of the students. Bloom (1974) described time on task as the amount of time that a student is actively engaged in learning while Greenwood, Horton, & Utley (2002) described similar specific behaviors indicative of engagement: writing, participating in tasks, reading aloud, reading silently, talking about academics and asking and answering questions. Walberg (1988) went even farther to distinguish between engaged time and *productive time*. He stated that productive time “is only a fraction of engaged time since conventional lessons rely on explanation, recitation, and discussion . . .” (p. 84). Productive time is characterized by students learning or applying their learning in ways unique to them.

Deconstructing the school day to better analyze how time is being used has yielded many different definitions. At the heart of the deconstruction effort is the desire to better understand how time is related to learning and achievement. The Carroll Model was built around the idea that time is a central variable in learning and that all students require different amounts of time to learn (Carroll, 1963). In 1974, Benjamin Bloom used the Carroll Model as a foundation for his learning paradigm, Mastery Learning. Mastery Learning holds that the variable in learning should be the amount of time for

learning rather than student mastery. Student mastery should be a constant. In this paradigm, “a formative criterion-based test is used to determine which students have reached the criterion of mastery and which students need additional time and help before they can reach the criterion” (Bloom, 1974 p. 684).

One wonders what would happen to achievement if it were held constant and allocated time was the variable, as suggested in Bloom’s *Mastery Learning*. In a study conducted by Gettinger and White (1970), the results indicated that the time it took the highest and lowest achieving students to meet the same criteria varied widely; faster students learned 6-9 times faster than slower students, suggesting that in an average classroom of mixed abilities, teachers must differentiate instruction if all students are to learn the same criteria.

This section has illustrated the wide range of ways that time is referred to and conceptualized in the context of education. Understanding the distinctions and nuances different authors attribute to these terms is important as the topic of instructional time is further explored. The next section features research on approaches to increasing academic achievement as measured by standardized test scores.

#### Factors Contributing to Academic Achievement

In this section, several studies of factors leading to academic achievement are presented. Some research has found that achievement gains can be attributed to increased time; other research has found that gains are attributed to other factors. Many educators and researchers have long held the notion that “more is better” with regard to the impact of time on learning (Walberg, 1988, Fisher, Mariliave, & Filby, 1977, 1977). However,

the solution to increasing academic achievement may be more complex than increasing time. This section will compare the findings of several studies addressing academic achievement.

### *Using Time Wisely*

Research has been conducted to better understand the ways that time and learning are related. Walberg (1988) discussed cognitive processes and issues related to time and learning, more specifically, the ways that time is used in the classroom. For example, breaking a learning session into two parts, with space between the two, is more effective than one longer session, an important consideration for configurations of instructional time. Walberg also discussed productive time as time that students are actually learning. This is differentiated from engaged time or time on task by the fact that students are not simply paying attention or completing an activity, but they are learning new information or new applications. Differentiating instruction can increase productive time. Examples of differentiated instruction include teaching small groups and individually managed study skills. Expansion of productive time is both effective and efficient; however, most instruction is based on “whole-class methods [that are] often inappropriate for individuals in heterogeneous groups” (Walberg, 1988, p. 84).

Fisher, Mariliave, and Filby (1977) conducted an exploratory study that found a positive relationship between instructional time and student achievement. They analyzed engaged time and allocated time and noted, “certain teaching behaviors and classroom conditions may result in more engaged time, which, in turn, will yield higher achievement (given a constant amount of allocated time)” (p. 38). An interesting note

about the research of Fisher, Marilave & Filby is that the quality of teaching during the allocated time did not appear to have an impact on learning. This is to say that within the allocated time, students could have received wide varieties of instruction, but those who received more instruction, experienced higher learning gains.

An illustration of productive time appeared in a study conducted by McGrath & Rust (2002). This project investigated the relationship between elementary school classroom organizational structures and standardized achievement scores, transition time between classes, and instructional time. Results indicated that self-contained (vs. students who move from teacher to teacher for different subjects) students made significantly greater gains in learning.

Interestingly, McGrath & Rust's (2002) study found no significant difference in instructional time between the two types of classes however. The difference in learning gains could be attributed to the fact that the self-contained teachers were using the additional time for enrichment activities such as computer lab, creative writing, and art. That is, the additional time was spent as productive time. While the students who were changing classrooms could be said to be "on task" (assembling materials, moving between classrooms, preparing for class), they were not being productive in the manner that the students in the self-contained class were. In this instance, the instructional time between the two test groups was the same, but it would appear that the additional time allowed for productive time with enrichment activities is what impacted learning.

Decreasing classroom interruptions was the focus of a study by Baugous and Bendery (2000). Their goal was to implement a series of environmental and instructional

approaches to decrease the number of interruptions caused by behavior issues and subsequently increase the amount of instructional time in the classroom. This project illustrates the effective use of cooperative learning, lessons addressing multiple intelligences, and best practices in classroom management to decrease classroom interruptions. The types of instructional approaches the researchers implemented are examples of those, which Walberg (1988) would suggest, foster productive time in the classroom.

Similarly, Leonard (2001) conducted a study of externally imposed classroom interruptions. Like Baugous and Bendery (2002), he wanted to analyze the demands on instructional time during the school day. Unlike the Baugous and Bendery study just cited, Leonard did not implement a strategy for change. The data he analyzed consisted records of interruptions from outside the classroom, presumably which the teacher has less control over. Leonard found that some of the most common interruptions are the public address system, phone calls, message delivery, other teachers, other students, and parents. He found that, in this age of accountability, interruptions, whether from within the classroom or from outside the classroom, are a major concern for teachers; they feel that instructional time is “squandered” or “eroded” (Leonard, 2001). Thus, the types and frequency of interruptions are important factors to keep in mind when discussing instructional time and the practices occurring within this time.

This section has highlighted research which focused on how time is used in the classroom. The goal of increasing student engagement or productive time appears to be the driving force for analyses of use of time in classrooms. Behavioral issues and day-to-



day school operations have been shown to consume instructional time. While increasing time is frequently considered to be an effective means of increasing achievement, careful consideration of what is occurring during allotted or planned instructional time is also necessary.

### *Class Size*

Decreasing class size is another approach used to increase achievement. Nye et al. (2002) analyzed the data gathered during a longitudinal, class-size study at the elementary level in Tennessee during the 1980's. Specifically, they analyzed the impact that smaller class sizes had on achievement of at-risk students on statewide assessments compared to their higher achieving counterparts. The data suggest that all students make achievement gains when placed in small classes. However, the extent to which the at-risk students' achievement improved varied according to subject level. In reading for example, lower-achieving students made higher gains than the higher-achieving students. In math however, at-risk students in the smaller classes made lower gains than the higher-achieving students. This is not to say that no gains were made, but the authors concluded that smaller classes should not necessarily be promoted as a means to close an achievement gap in all subject areas. Are smaller classes better? "According to Nye, . . . While there is strong evidence that small classes benefit all students, the evidence of differential benefits for lower achieving students is both weak and contradictory" (Nye et al., 2002, p. 215).

A study conducted in West Virginia analyzed elementary test scores from the late 1990's. Like Nye et al. (2002), Wilkins (2002) was curious to see if there was a

relationship between small class sizes and achievement. He concluded that, unless the class is smaller than 15 students, there would not be a statistically significant relationship between scores and class size. Instructional practices and settings in classes of 15 and fewer have a variety of confounding variables and therefore the reduced number of students cannot be considered the only attribute to the difference in test scores (Wilkins, 2002).

A study conducted in 2001 by Penny Fidler focused on the achievement of third, fourth, and fifth grade students in California during a sweeping movement to lower class sizes. Fidler wanted to analyze the differences in achievement levels among students who had been placed in smaller class sizes for one year, two years or three years prior to the study; in other words, would any gains in achievement persist if the students were returned to larger classes? Like the Nye et al. (2002) analysis of the Tennessee class size study, Fidler's 2001 study showed gains across the board in mathematics and reading. Fidler found that once removed from smaller classes, the effect size of the gains diminished in all subjects at all grade levels with the exception of in fifth grade math. This demonstrates a jump in achievement at the fifth grade level, leading to the question of why there is a lag in mathematics achievement in the earlier grades.

Stasz and Stecher (2000) studied instructional practices in reduced sized classes. In their studies of the California reduced class size effort, they also found that mathematics achievement improved across the board. The instructional practices and resources they observed in the smaller classes included more teachers with Master's degrees, more time playing math games, and more time devoted to using patterns to find

relationships in math. Differences in instructional practices noted in smaller classes are perhaps a key to explaining the difference in achievement between students in smaller classes and those in larger classes.

Pong and Pallas (2001) used the data collected from the 1997 Third International Math and Science Study (TIMSS) to analyze class sizes and student achievement at the middle school level. More specifically, the project “investigates the processes through which small class size might directly or indirectly affect math achievement . . .” (p. 254). The two areas thought to be impacted by smaller numbers in the classroom are coverage of the curriculum and instructional organization and delivery. These two areas are examples of the confounding variables that Wilkins (2002) refers to and that Stasz and Stecher (2000) studied. Because data in the TIMSS were “crude,” the authors felt that controlling for these variables was difficult, but they were able to conclude that in the United States, in classes of 6-18 students, students outperformed classes with 19-29 students. On the other hand, in other countries, the opposite was true: Students in larger classes were higher achieving than students in smaller classes.

In this section, the outcomes of several studies addressing class size were discussed. To summarize, smaller classes do seem to increase the achievement of most students, but researchers are quick to point out that a shorter class list could imply that teacher practice is different, curriculum is presented differently, time is utilized differently, and teachers may be more experienced or educated. In the next section, research addressing instructional practices will be reviewed and discussed with relation to student achievement.



### *Instructional Practices*

The role of instructional practices has been touched on in the previous sections. The amount of time devoted to instruction and the number of students in a class are quantifiable factors that are relatively easy to measure. Instructional practices could be considered more difficult to measure due to their qualitative nature. The importance of the quality of instructional practice is evident in the body of research on student achievement. In this section, several studies focusing on instructional practices that lead to higher academic achievement will be reviewed.

In a study published in 2004, Harold Wenglinsky analyzed the achievement gap in mathematics at the fourth-grade level. He used data from high-achieving students on the National Assessment for Educational Progress (NAEP) to investigate the instructional practices that might have contributed to the high outcomes, and thus, diminished the achievement gap. Twenty different practices were analyzed: two related to time, four related to teacher philosophy, five related to content, and nine related to specific techniques utilized by the teacher. Wenglinsky found that students who spent more time studying math ranked higher on the NAEP and students whose teachers conducted routine exercises in math ranked higher. However, frequently testing students and emphasizing math facts rather than skills like reasoning and communication are two examples of instructional practices that resulted in lower rankings. Additionally, Wenglinsky found that fourth grade teachers devoted the most time to numbers and operations, yet the areas of greatest need for minority students are in other areas

(estimation and computation for African American students and working with data for Latino students).

In the second part of a series of studies on the outcomes of California's class size reduction program, Penny Fidler (2002) studied the relationship between instructional practices and student achievement on a statewide standardized test. In this follow-up study, her goal was to identify which teaching strategies were significant predictors of student achievement. Teachers were observed as they taught. An initial list of 20 teacher practices was developed and the observed practices were categorized and reduced to three major themes: individualization and engagement; redundancy, practice, and modeling; and classroom management. The results showed specific teacher behaviors and attributes that predicted achievement in reading and language, but a significant, predictable relationship between teacher factors and math achievement was not found.

The instructional practices that Wenglinsky (2004) identified as having a significant relationship to math achievement also occurred within the context of specific topic areas, suggesting that the relationship between teacher practice and student achievement is strongest when instruction is implemented in a focused manner. In the Stasz and Stecher (2000) study of instructional practices in reduced class sizes, a set of instructional practices was associated with math achievement. These included the amount of time devoted to math games and working with math patterns. Due to the research design of this study, specific instructional practices could not be linked to individual student scores. However, these three studies illustrate that students need different instructional approaches in different subject areas.

Baugous and Bendery (2000) utilized a multi-faceted approach to instructional practices which sought to decrease behavioral interruptions and, subsequently increase time on task. Some of the specific teacher practices they addressed included: teaching social skills, using cooperative grouping and cooperative learning structures in reading and math, use of graphic organizers, adaptation of lessons to address multiple intelligences, and consistent enforcement of clearly defined expectations and consequences. While this study did not address a relationship between a decrease in behavioral interruptions and academic achievement, it did demonstrate a relationship between specific instructional practices and a decrease in behavioral interruptions. One could make the assumption that with fewer interruptions, more time could be devoted to instruction thus impacting academic achievement.

The importance of instructional practice on student achievement was reviewed in this section. Due to the qualitative nature of teacher practice and the many variables at work in the classroom setting, it can be difficult to pinpoint precise practices that lead to improved achievement. However, the research does indicate that specific classroom management practices, individualization of instruction, opportunities to practice, and modeling processes or procedures are related to student achievement.

Instructional practices, reducing class size, and maximizing the use of time with students are examples of three areas of focus for improving student achievement. These three areas are closely related. For example, given a smaller class size, it is possible that instructional practices are modified. Reviewing research on these factors provides insight as to what school districts and teachers are doing to increase academic achievement.

### Summary of the Literature Review

This synthesis of literature related to time and academic achievement in math serves as the background for a study that compares the effects of two different adaptations to the use of instructional time in two elementary schools. Several themes pertaining to the use of time and student achievement emerged from the literature.

First, research and data illustrating the achievement gap at the national and state levels were presented. Current and historical data demonstrate the existence and persistence of a White/non-White achievement gap. In the state of Alaska, current data illustrate that at the present time, there is a significant gap between the achievement of White and non-White students.

Next, this review of the literature compared the many different conceptualizations and uses of time in the classroom. The many different definitions and conceptualizations illustrate the complexity of scheduling, teaching, and learning within the hours of a typical school day. Attention must be given to how time is allotted and used in order to maximize student learning and achievement. Instructional time must be protected from outside interruptions and the goal of instruction should be to increase productive time of students. Caution should be employed when considering simply lengthening class periods or school days without considering what instructional practices are routinely occurring.

Finally, a variety of factors that impact academic achievement were reviewed and discussed. Smaller classes have, in some instances, been found to contribute to increased academic performance. This approach has yet to be shown to be effective as a means to effectively narrowing the achievement gap however (Nye et al., 2002, p. 215). In some

instances, instructional practice was observed to be different in smaller classes (Stasz & Stecher, 2000).

In one study of the relationship between instructional practices and student achievement, practices that increased achievement in reading and writing did not yield the same relationship in math (Fidler, 2002). This outcome is corroborated by Wenglinsky's (2004) findings which indicated that the relationship between teacher practice and student achievement is strongest when implemented in a focused manner. To summarize, employing a wide variety of interrelated and cohesive instructional practices will do more to promote an increase in academic achievement than attempting to implement one single approach.

Two schools' approaches to a component of NCLB prompted this study. Administrators and their staffs submitted School Improvement Plans that featured increased instructional time as a key means by which to improve the academic achievement of certain populations of fifth grade students as measured by standardized statewide tests. Opting to increase instructional time was a strategy worthy of study for two reasons. First, because the majority of the research on instructional time concludes that the quality of teaching within instructional time is critical to increasing achievement. Second, given the materials and other resources teachers and schools had access to (as a result of the school district's Improvement Plan), both schools chose to increase instructional time in math. School A teachers taught an extended block period and School B teachers taught two separate math periods each day.

This study was designed to be an exploratory, quantitative study, analyzing the 2004 and 2005 TerraNova/CAT6 test scores of the fifth-graders at each school. The scaled scores will be compared by individual student to compare quartile rankings on the pre- and post tests.



## Chapter Three

### Methodology

This chapter explains the methods used to analyze the data in this study. The perspective, participants, instrumentation, methods for data collection and data analysis will be described.

#### The General Perspective

This quantitative study analyzed data taken from standardized math assessments of fifth graders at two elementary schools in Fairbanks, Alaska. Data were analyzed to see if a statistically significant difference at the .05 level of significance existed between the students' scores at these two elementary schools after two different instructional treatments were applied. These particular schools were selected because math was a targeted area of academic need and the administration and staff at these schools had voluntarily chosen to address the need by implementing scheduling changes in math instruction.

#### The Research Context/Participants

The data used in this study consists of public domain, program assessment data. The study was therefore not subject to Institutional Review Board review.

Participants were selected in a non-random manner from two elementary schools in the same school district. The first school will be referred to as "School A." At the time of the study, School A served approximately 450 students. Of these, approximately 66% were White, 20% were American Indian or Alaska Native, 5% were Black, 4% were Hispanic, and 4% were Asian. The second school, which will be referred to as "School

B,” served approximately 346 students. Of these, 37% were white, 35% were American Indian or Alaska Native, 17% were Black, 6% were Hispanic, and 5% were Asian. See figure 3.1.

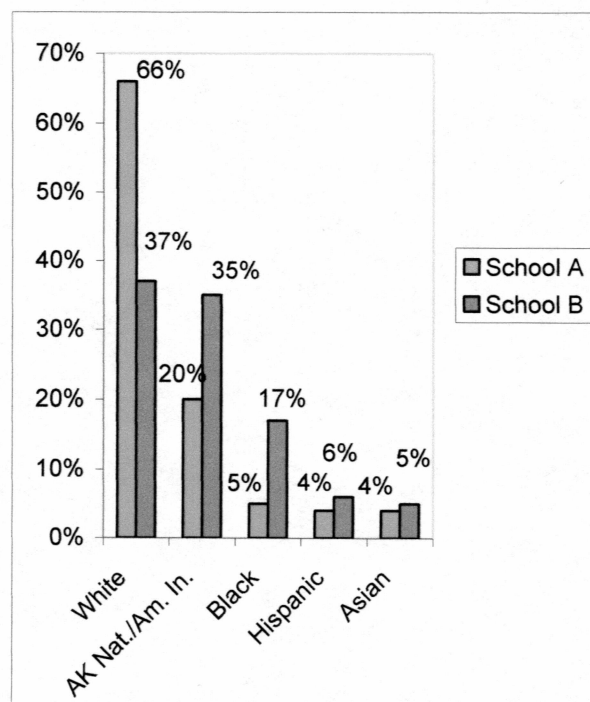


Figure 3.1. Demographic Comparison

School B was classified as a Title I school on the basis of its population of students qualifying for free and reduced lunches according to the guidelines set by the federal government. During the 2003/2004 and 2005/2005 school years, School A did not qualify as a Title I school. (The differences between the Title I classification of these two schools is relevant to this research because the Federal government views a school’s Title I status as an indicator of need for additional resources to address issues related to at-risk students. School B therefore, received additional funding and resources that School A did not.)



In this study, data from individual students' fourth grade year were compared to data from individual students' from the fifth grade year. Data from students who moved out of the attendance area of either school were removed from the study. Likewise, data from students who moved into either attendance area from another school not participating in the study were not included in the study. There were no instances of students who attended one of the schools during the first year, but then moved to the attendance area of the other school.

Three classrooms from School A were participating in this study. Class X had 25 students, 16 of which had complete data for this study; class Y, a fourth /fifth grade split, had 16 fifth grade students, 12 of which had complete data for this study; and class Z had 27 students, 17 of which had complete data for this study. Two classrooms from School B were participating in this study. Class P had 21 students, 16 of which had complete data for this study; and class Q had 20 students, 15 of which had complete data for this study. In all, data from 76 students and five teachers were analyzed.

#### Instrumentation

The assessment instrument used was the Terra Nova California Achievement Test Version 6 (Terra Nova/CAT 6) published by CTB McGraw Hill. The TerraNova CAT/6 is a norm-referenced test published by CTB McGraw Hill and fulfills the State of Alaska's reliability and validity requirements for statewide assessment. The test is suitable as an indicator of students' achievement because it is based on the Alaska Standards and Grade Level Expectations, upon which classroom teachers base instruction.

The data that were analyzed were the scaled scores from two different administrations of the math section of the TerraNova/CAT 6; more specifically, the February 2004 and February 2005 administrations to students of the class of 2012.

#### Procedures Used

The data analyzed for this study were public records maintained by the Fairbanks North Star Borough School District. Students were assigned to groups based on the school the student attended and could therefore be considered a non-random grouping. The February 2004 administration of the TerraNova/ CAT 6 was considered the pretest to determine baseline scores. Approximately six months prior to the second administration of the TerraNova/CAT 6, the schedules for math instruction at both schools were altered. The February 2005 administration of the TerraNova/CAT 6 served as the posttest.

#### Data Collection and Analysis

The raw data collected included the pre- and posttests for School A and the pre- and posttests for School B. Raw data were organized in a spreadsheet format and grouped according to school and year.

The mean scores and variances were identified then a box plot test determined that in school B, one score was considered an outlier. This finding will be presented and discussed in the results section.

The treatments in this study were the two different scheduling configurations for math instruction. The first, employed at School A, was a longer uninterrupted block of instructional time. The second, employed at School B, was the addition of a second period of instruction, scheduled separately within the school day.

In order to determine whether a statistically significant difference exists between either of the schools' test scores, the mean pre-and posttest scores were compared using a paired t-test. In the case of School B, the paired t-test was conducted once with the outlier score and once without the outlier score. Both outcomes will be compared to the t-test results of School A.

## Chapter Four

### Results of the Study

The purpose of this study was to understand whether two different approaches to increased instructional time led to a statistically significant increase in math achievement of fifth grade students. The results of this study are presented in this chapter. To review, the null hypothesis guiding this study was that there would not be a statistically significant difference at the .05 level of significance between the math scores of fifth grade students at schools A and B, as measured by standardized tests.

#### School A

The mean scores for Schools A and B are displayed in Figure 4.1. The sample size at school A was 45 students. The mean score on the pretest at School A was 646.489

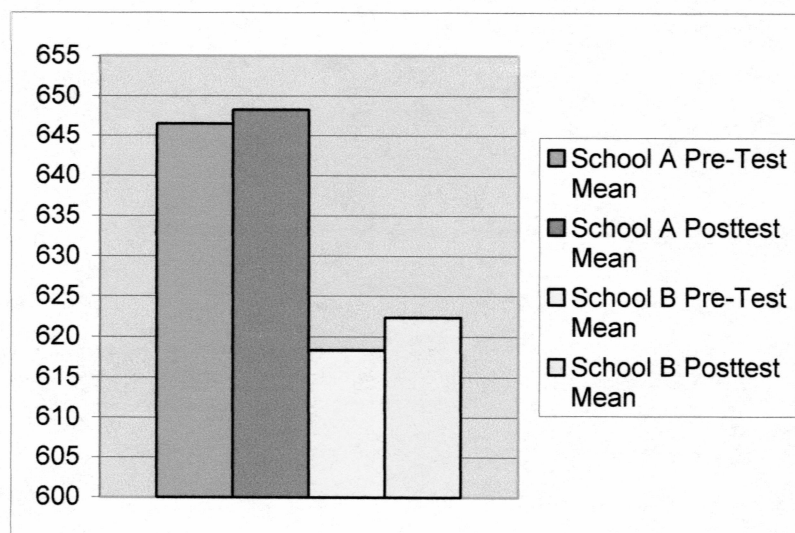


Figure 4.1 Comparison of Mean Pre-and Posttest Scores

and the mean posttest score was 648.244. There was a range of 150 points between the highest and lowest scores on the pretest and a range of 135 points on the posttest of fifth grade students at School A. While the difference in students' score ranged from a

decrease of 57 points to an increase of 56 points, the mean difference between the pre- and posttest was 1.756 points.

#### School B

Initial statistical analysis of the data for school B revealed an exceptional set of data that was treated as an outlier in all subsequent analyses. The inclusion or exclusion of this data in reporting of results will be explicitly stated.

The sample size at school B was 30 without the outlier data set and 31 if it was used. School B's pretest scores had a range of 183 points and posttest scores had a range of 118 points, not including the outlier. When the outlier data were included, the range changed from 285 on the pretest to 118 on the posttest. The difference in scores ranged from a decrease of 49 points to the unusual increase of 210 points. Excluding this exceptional data set however, the next highest increase was 91 points.

Using all of the complete data sets, the mean difference between pre- and posttest scores at school B was 10.667. Excluding the data set identified as an outlier, the mean difference between pre- and posttest scores at school B was 4.033. See Table 4.1. A paired t-test was performed to determine whether a statistically significant difference existed at the .05 level of significance between the mean score difference of school A and school B. The analysis was performed twice, once using the set of data with the outlier from school B and once excluding this data. The result of the first test was .096. The result of the second test was .342. Neither result is statistically significant at the .05 level; therefore the hypothesis cannot be rejected.

Table 4.1. School B Pre- and Posttest Data With and Without Outlier Data

	School B Pretest		School B Posttest		School B Difference	
	With Outlier	Without Outlier	With Outlier	Without Outlier	With Outlier	Without Outlier
Mean	611.419	618.366	622.096	622.4	10.677	4.033
Minimum	403	505	569	569	-49	-49
Maximum	688	688	687	687	210	91
Count	31	30	31	30	31	30

The data were further analyzed according to quartile ranking. The mean differences in scores of each quartile at each school were analyzed. At both schools, the greatest mean difference in scores were made by students in the first quartile and the least mean difference in scores were made by students in the fourth quartile. See Table 4.2.

The number of students scoring in each of the quartiles was also compared. After the posttest, the number of students scoring in the fourth quartile decreased nearly by half at both schools and at school B, the number of students ranked in the first quartile approximately doubled. See Table 4.3.

Individual student pre- and posttest rankings are displayed in Table 4.4. This display demonstrates the movement between quartile rankings. When observing the data in this format, a few patterns emerge. First, at school A, there are fewer students ranked in the first quartile on the posttest; three of these students were ranked in the first quartile on the pre-test. In these students' situations, their increased scores did not result in a change in their quartile rankings.



Table 4.2 Comparison of Mean Differences by Pretest National Quartile

	School A	School B With Outlier	School B Without Outlier
First Quartile	33	72	49
Second Quartile	12.4	-9.5	-9.5
Third Quartile	13.167	-1.4	-1.4
Fourth Quartile	-6.667	-8.154	-8.154

Table 4.3 Comparison of Number of Students in Each National Quartile Ranking

	School A		School B, With Outlier		School B, Without Outlier	
	Pretest	Posttest	Pretest	Posttest	Pretest	Posttest
First Quartile	4	4	7	13	6	13
Second Quartile	5	8	6	5	6	4
Third Quartile	6	17	5	8	5	8
Fourth Quartile	30	16	13	5	13	5



Table 4.4 Comparison of Pre- and Posttest Quartile Ranking By Student

School A			School B (with outlier)		
Student	Pre-test	Posttest	Student	Pre-test	Posttest
1a	1	1	1b	1	1
2a	1	1	2b	1	1
3a	1	1	3b	1	2
4a	1	2	4b	1	1
5a	2	2	5b	1	2
6a	2	2	6b	1	1
7a	2	2	7b	1	2
8a	2	3	8b	2	1
9a	2	1	9b	2	1
10a	3	2	10b	2	1
11a	3	4	11b	2	1
12a	3	3	12b	2	1
13a	3	2	13b	2	1
14a	3	3	14b	3	1
15a	3	3	15b	3	3
16a	4	3	16b	3	3
17a	4	3	17b	3	3
18a	4	3	18b	3	1
19a	4	2	19b	4	4
20a	4	3	20b	4	2
21a	4	4	21b	4	4
22a	4	3	22b	4	3
23a	4	3	23b	4	2
24a	4	4	24b	4	3
25a	4	3	25b	4	1
26a	4	3	26b	4	4
27a	4	4	27b	4	3
28a	4	3	28b	4	4
29a	4	4	29b	4	4
30a	4	4	30b	4	3
31a	4	3	31b	4	3
32a	4	2			
33a	4	3			
34a	4	4			
35a	4	4			
36a	4	4			
37a	4	4			
38a	4	4			
39a	4	3			
40a	4	3			
41a	4	4			
42a	4	4			
43a	4	4			
44a	4	4			
45a	4	4			

A second point of interest is in the scores of School B students who were ranked in the second quartile on the pre-test. Each of these students was ranked in the first quartile after the posttest, accounting for a significant portion of the posttest numbers in that category. Students in this quartile ranking had the greatest negative mean difference between pre- and posttest scores.

Finally, when looking at the individual third quartile ranking of students at Schools A and B, we can see the impacts of high individual scores on small sample sizes. For example, at School A we can see that the large mean difference between pre- and posttest scores (13.167) is influenced a great deal by one student's increase of 56 points. Of the six students in the third quartile, two dropped to the second quartile on the posttest, three remained in the third quartile and one made a rather significant increase and moved into the fourth quartile. This one student however impacted the mean score for the overall group. Likewise, at School B of the five students in the third quartile, one student's mean difference was a large negative value (-46), dropping the student to the first quartile, and thus impacting the overall mean difference of the quartile group.

### Chapter Summary

This chapter has presented the results of the 2004 and 2005 administrations of the TerraNova/CAT 6 at two elementary schools. The mathematics scores of fifth grade students were analyzed after teachers applied two different treatments of instructional time over a six-month period. When the groups were analyzed as a whole, the results indicated that the effect of the two different applications of time on the mean difference was statistically insignificant at the .05 level of significance. However, when the data

were disaggregated, the size of the effect increased according to the pretest quartile ranking. At both schools, the greatest mean difference in scores came from students ranked in the lowest percentile. Likewise, at both schools, the least mean difference in scores came from students ranked in the highest percentile. The next chapter will further discuss the results and implications of this research.

## Chapter Five

### Summary and Discussion

The purpose of this study was to determine whether two different approaches to increased instructional time led to a statistically significant increase in math achievement of fifth grade students. The null hypothesis stating that there would not be a statistically significant difference at the .05 level of significance between the math scores of the fifth grade students at schools A and B, as measured by standardized test scores, could not be rejected. The results presented in the previous chapter reviewed the mean differences in pre- and posttest scores between schools A and B on the standardized assessments and quartile rankings. This chapter will discuss the results in light of the research presented in chapter two, state the limitations of the study, and offer suggestions for future areas of research.

### Discussion

More instructional time, in either treatment, did not affect overall mean achievement at the .05 level of significance in this study. This section will discuss the results from within each school.

#### *School A*

To review, School A implemented a longer uninterrupted block of instructional time. According to a 1977 study, Fisher, Mariliaeve & Filby concluded that within an allotted amount of time, students could receive differing types or qualities of instruction, but those who receive more instruction would experienced higher learning gains based on the premise that longer periods of allotted times might result in longer periods of engaged

time. If the results of that study hold true for school A, one would expect to see an increase between the pre-and posttest scores and, at minimum, a consistent distribution across the quartile rankings. This did not occur however.

At School A, the students ranking the in the lowest quartile on the pretest had the greatest mean increase of all, increasing 33 points from the pretest to the posttest. The actual number of students ranked in the first quartile however stayed the same from the pretest to the posttest. On the other hand, the of number students who were ranked in the highest quartile on the pretest was reduced by half after taking the posttest. The mean difference in scores for this group was a decrease of 6.667 points. The implication for the teachers at school A appears to be that treatment of a longer uninterrupted block of instructional time was indeed beneficial for the lower achieving students, but it appears to be a detriment to the higher achieving students.

The qualities of teachers and classrooms were not a component of this study and were not therefore a subject of data analysis. However, there were patterns to be highlighted as topics of future research and discussion at School A. Class Y was a fourth/fifth grade split with 26 students total, 16 of whom were fifth graders and 12 of those were participating in this study. All 12 of the participants ranked in the fourth quartile on the pre-test; however, after the treatment of extended instruction, only four of the 12 ranked in the fourth quartile.

Results of standardized tests like these may be a source of great frustration to teachers and families. For example, the large improvements made by students in the first quartile were significant, but not enough to move them from the first quartile. When a

teacher's instructional progress is being measured, unfortunately the overall point gains are not considered. Furthermore, it can be the victories with the lowest achieving students, most challenging of learners that are the most rewarding for a teaching staff and yet, the teachers' accomplishments go unnoticed or unrecognized in the standardized system of accountability.

### *School B*

The principal at School B chose to address the issue of low math achievement by requiring that instructional time be increased to two math periods each day. This model would be a variation of a scheduling configuration in research conducted by Herbert Walberg (1988) who concluded that breaking a learning session into two parts, with space between the two, is more effective than one longer session. After six months the results varied according to the achievement level of the students.

School B included a student that scored a difference of 210 points between the pre- and posttest. This student's data were considered outliers, but were included in analyses because it was impossible to identify circumstances that would invalidate the data. It is possible that this student was unable to complete the pretest or that the student did complete the pretest and improved 210 points. Since there is not a means to verify which situation occurred, School B's outcomes are being discussed with and without this student's data.

Like School A, the greatest difference between School B's pre- and posttest scores were achieved by the students ranked in the lowest quartile on the pretest. This was the only group that achieved positive mean difference; the mean differences of the



other quartiles were negative values. When student movement is tracked across quartile rankings (see Table 4.4), you see that nearly half of the students who were initially ranked in the lowest quartile moved into the second quartile ranking. This demonstrates that the lowest achieving students made gains in achievement between the pre- and posttests. However, despite the positive mean difference between pre- and posttest scores, the number of students ranked in the lowest quartile doubled. Also similar to School A, the number of students ranked in the highest quartile after the treatment of two math sessions was reduced by half. No clear patterns emerged between the scores of Classrooms P and Q.

It would appear that the addition of a second math session was not useful to significantly increase the math achievement of the lowest achieving students and was detrimental to the higher achieving students. The two spaced sessions suggested by Walberg (1988) did not appear to have the same effect in this study.

If choosing to continue this scheduling configuration, the teachers and administration at this school may want to consider studying the instructional strategies, classroom management approaches, or materials they are using to teach math. Baugous and Bendery (2000) and Wenglinsky (2004) address these qualitative factors in their research. Their findings suggest that teacher practice and instructional practice have as much influence on achievement as additional instructional time.

#### Limitations of the Study

One limitation of this study was the small scope. This exploratory study was purposefully based on a convenience sample of administrators and teachers who were

voluntarily implementing the scheduling treatments in response to the academic needs of low achieving students. Evidence of this limitation is discussed in the results of one student's high increase influencing the difference in the third quartile at School A. A similar situation existed at school B with the exception that the score decreased, lowering the mean difference. Were this study to be reproduced, soliciting a larger number of schools and classroom teachers willing to implement one of the two treatments might add to the validity of the findings.

Another limitation of the study includes the duration of the treatment: In this study, students were exposed to the treatment for six months. Perhaps longer exposure would have resulted in different outcomes. Finally, no research was conducted in the classrooms, observing the teachers' interactions with the students, reviewing materials, or interviewing subjects.

#### Areas for Future Research

An interesting area for future research would address the qualitative aspects of instruction when instructional time is increased. For example, one might study the impact of a longer block of instructional time on a teacher's ability to manage classroom behaviors, present meaningful lessons, or engage students in a variety of learning styles. This data could then be analyzed according to teacher qualities such as years of teaching experience, level of education, and ethnicity and compared to student qualities. Finally, it would be very interesting to study students' perceptions of each learning situation and how they experience the qualitative aspects of instruction within each.

## Conclusion

This purpose of this exploratory study was to understand the relationship of two schools' approaches to increasing instructional time and the mathematics achievement of fifth-grade students on the TerraNova/CAT-6. School A chose to teach a longer, uninterrupted block of math and school B chose to teach two math sessions each day. By comparing the results of the Terra Nova/CAT 6 after approximately six months of increased instructional time, the results indicate that the lowest achieving students scored the greatest mean difference in scores, but that students at neither school significantly increased in math achievement at the .05 level of significance.

This study supports research of Wenlingsky (2004) and Gettinger & White (1970) who concluded that without certain qualitative features, increased time alone would not result in increased achievement. The nature of this study did not allow for investigation of the qualitative features of the teachers, classrooms, or materials of School A or B.

However, the outcomes of this study did not support the findings of Fisher, Mariliave, and Filby (1977) who concluded that students could receive wide varieties of instruction within allocated time, but those who receive more instruction made higher achievement gains. Additionally, Penny Fidler's work in 2001 analyzing the persistence of academic gains from smaller class sizes demonstrated a jump in math achievement at the fifth grade level when students lagged in other areas and at other grade levels. Both of these studies suggest that the outcomes at Schools A and B might have been anticipated to be higher.

Given the outcome of this study, it is apparent that school districts, administrators or teachers who are evaluating scheduling plans to increase student achievement in math should consider plans that do include consideration of the qualitative aspects of teachers, classrooms, or materials. Additionally, prior to implementing a plan, research should be conducted to ensure that the chosen approach has been studied and has proven to yield statistically significant results within a similar context.

To effectively address the achievement gap in mathematics, administrators and teachers must be willing to commit to a process that will involve a long term, spiraling process of planning, application, assessment and evaluation. Attempts such as this one by Schools A and B are valuable and important foundations which should be shared and built upon throughout their school district for more efficient program planning and delivery on behalf of minority students. No single attempt can be expected to close an achievement gap that has existed for decades. Instead, teachers at both schools can use the knowledge and insight that they learned about instructional techniques and their students and modify the approach, beginning the process once more.

## References

- Baugous, K., & Bendery, S. (2000). *Decreasing the amount of classroom disruptions in order to increase the amount of time on task in elementary students*. Unpublished master's thesis, Saint Xavier University, Chicago.
- Bloom, B.S. (1974, September). Time and learning. *American Psychologist*, 682-688.
- Carroll, J. B. (1963). A model of school learning. *Teachers College Record*, 64, 723-733.
- Dempster, F.N. (1987). Time and the production of classroom learning: Discerning implications from basic research. *Educational Psychologist*, 22(1), 1-21.
- Education Trust, Inc. (2001). *State summary of Alaska. Ed watch online*. (Report No. UD-034-474). New York, NY: Carnegie Corp. of NY. (ERIC Document Reproduction Service No. ED549222)
- Education Trust, Inc. (2003). *Education watch: Alaska. Key education facts and figures. Achievement, attainment and opportunity. From elementary school through college*. (Report No. UD-035-741). Washington, D.C.: U.S. Department of Education. (ERIC Document Reproduction Service No. ED478502)
- Education Trust, Inc. *Education watch: Achievement gap summary tables*. Retrieved December 2, 2004, from <http://www.edtrust.org>.
- Fidler, P. (2001). *The impact of class size reduction on student achievement*. (Report No. LAUSD-PARD-109). Los Angeles, CA: Los Angeles Unified School District: (ERIC Document Reproduction No. ED474386)

- Fidler, P. (2002). *The relationship between teacher instructional techniques and characteristics and student achievement in reduced size classes*. (Report No. LAUSD-PARD-120). Los Angeles, CA: Los Angeles Unified School District. (ERIC Document Reproduction Service No. ED473460).
- Fisher, C.W., Marliave, R.S., & Filby, N.N. (1977). Instructional time and student achievement in elementary school. *California Journal of Teacher Education*, 4(2), 23-39.
- Frederick, W.C., & Walberg, H.J. (1980). Learning as a function of time. *Journal of Educational Research*, 73, 183-194.
- Gettinger, M., & White, M.A. (1970). Which is the stronger correlate of school learning? Time to learn or measured intelligence? *Journal of Educational Psychology*, 71, 405-416.
- Greenwood, C.R., Horton, B.T., & Utley, C. A. (2002). Academic engagement: Current perspectives on research and practice. *School Psychology Review*, 31, 328-349.
- Haycock, K. (2002, Summer). Still at risk. *Thinking K-16*, 6(1).
- Lee, J. (2002). Racial and ethnic achievement gap trends: Reversing the progress toward equity? *Educational Researcher*, 31(1), 3-12.
- Leonard, L.J. (2001). From indignation to indifference: Teacher concerns about externally imposed classroom interruptions. *Journal of Educational Research*, 95, 103-109.



- Lysiak, F. (1980). Time utilization study: Classroom observation 1979-1980. Fort Worth TX: Fort Worth Independent School District, Texas Department of Research and Evaluation.
- McGrath, C.J., & Rust, J.O. (2002). Academic achievement and between-class transition time for self-contained and departmental upper-elementary classes. *Journal of Instructional Psychology*, 29, 40-43.
- Montgomery, P., Ranney, S., & Growe, R. (2003). *High-stakes testing versus high-quality education*. (Report No. TM-035-318). Lafayette, LA: University of Louisiana at Lafayette. (ERIC Document Reproduction Service No. ED481061)
- Nye, B., Hedges, L.V., & Konstantopoulos, S. (2002). Do low-achieving students benefit more from small classes? Evidence from the Tennessee class size experiment. *Educational Evaluation and Policy Analysis*, 24(3), 201-217.
- Pong, S., & Pallas, A. (2001). Class size and eighth-grade math achievement in the United States and abroad. *Educational Evaluation and Policy Analysis*, 23, 251-273.
- Stasz, C., & Stecher, B. (2000). Teaching mathematics and language arts in reduced size and non-reduced size classrooms. *Educational Evaluation and Policy Analysis*, 22(4), 313-330.
- Suarez, T.M., Torlone, D.J., McGrath, S.T., & Clark, D.L. (1991). *Enhancing effective instructional time: A review of the research*. Chapel Hill, NC: North Carolina State Board of Education. (ERIC Document Reproduction Service No. ED373409).

- Walberg, H.J. (1988). Synthesis of time and learning. *Educational Leadership*, 45(6), 76-85.
- Wenglinsky, H. (2004). Closing the racial achievement gap: The role of reforming instructional practices. *Education Policy Analysis Archives*, 12(64), 1-23.
- Wilkins, W.E. (2002, March). *No simple solution: Do smaller classes, more experienced and educated teachers, and per pupil expenditure really make a difference?* Paper presented at the Annual International Conference of the Society of Educators and Scholars.